

Bacteria



Would you believe that a single gram of soil, which is about the mass of a pencil eraser, may have more than 2.5 billion bacteria? A handful of soil may contain trillions of them!

The group Bacteria consists of single-celled organisms (meaning they are made of just ONE cell) that do not have a nucleus. Bacteria live in soil, water, and even inside other organisms. Some Bacteria have relatives that date back about 3.5 billion years!

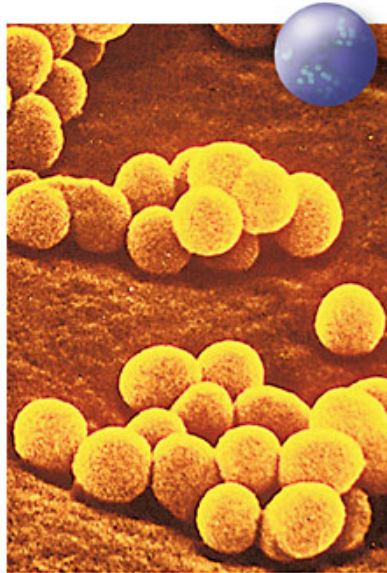
Some Characteristics of Bacteria

There are more bacteria on Earth than there are all other living things combined. Most bacteria are too small to be seen without a microscope. But not all bacteria are the same size.

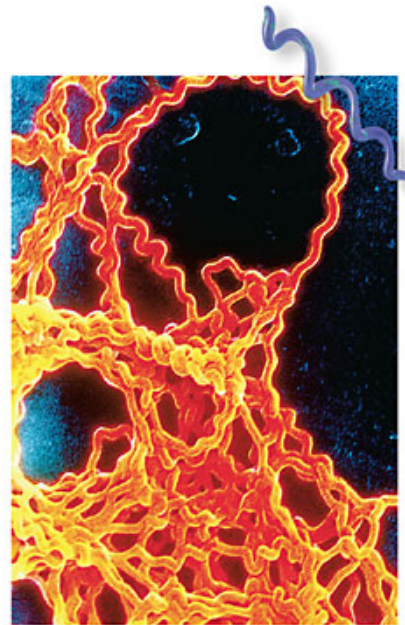
Bacteria are usually one of three main shapes: rod shaped, spherical (like a ball), and spiral shaped. Most bacteria have a tough cell wall that gives them this shape. Each shape helps bacteria in a different way.



Bacilli (buh SIL iE) are rod shaped. They have a large surface area, which helps them take in nutrients. But a large surface area can cause them to dry out easily.



Cocci (KAHK SIE) are spherical. They do not dry out as quickly as rod-shaped bacteria.



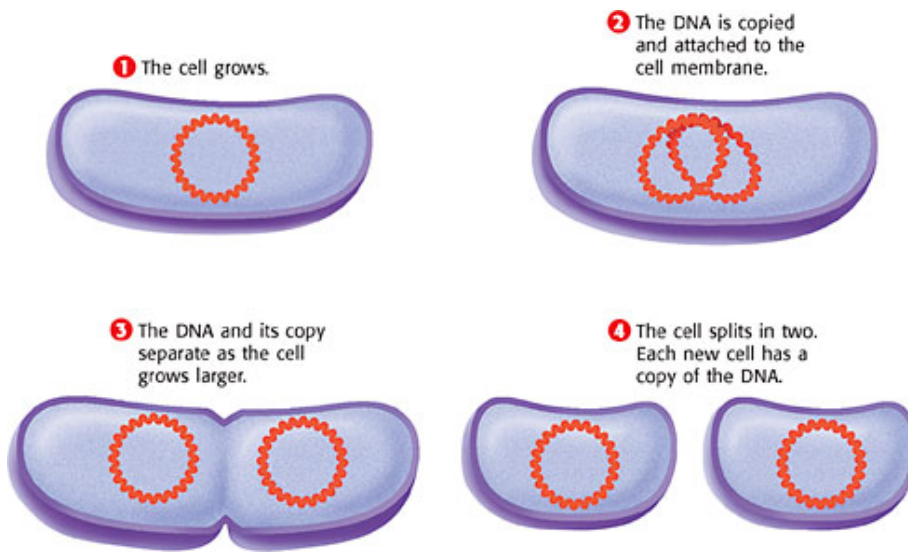
Spirilla (spie RIL uh) are long and spiral shaped. They use flagella at both ends to move like a corkscrew.

Alone or Together!

Bacteria are organisms by themselves, but some bacteria stick together to form strands or films. Most bacteria are much simpler and smaller than organisms you are familiar with. Bacteria also reproduce differently than other organisms.

Bacteria Reproduction

Bacteria reproduce when one single-celled organism simply splits into two single-celled organisms.



How Bacteria Eat

Most bacteria get their food by eating other organisms. Many bacteria feed on dead organisms, and other bacteria live in or on the body of another (living) organism. Some bacteria can even make their own food using energy from the sun.

Humans couldn't live without bacteria, but bacteria can also cause harm. Scientists learned in the 1800s that some bacteria cause disease. These bacteria get inside another organism and take nutrients (food/energy) from the cells. In the process, they harm the organism. Today, we are protected from many bacterial diseases by vaccination. Many bacterial diseases can also be treated with antibiotics.

Diseases in Other Organisms

Bacteria cause diseases in other organisms as well as in people. Have you ever seen a plant with odd-colored spots? If so, you've seen bacterial damage to plants. Some bacteria attack plants, animals, fungi, and even other bacteria. They can cause damage to grain, fruit, and vegetable crops. Plants are sometimes treated with antibiotics. Scientists have also genetically engineered certain plants to be resistant to disease-causing bacteria.

Viruses



A **virus** is a microscopic particle, which means you can only see them with a microscope. They can get inside cells, and when they do they often destroy the cell. Many viruses cause diseases, such as the common cold, flu, and acquired immune deficiency syndrome (AIDS).

It's a Small World

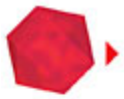
Viruses are VERY tiny. They are smaller than the smallest bacteria. About 5 billion virus particles could fit in a single drop of blood.

Are Viruses Living?

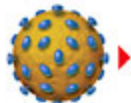
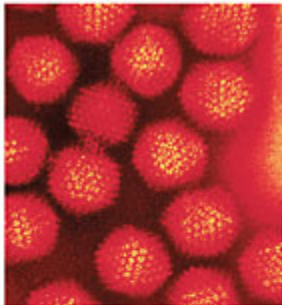
Like living things, viruses contain protein and DNA. But viruses don't act like living things. They can't eat, grow, or use oxygen. Viruses are also not cells. In fact, a virus cannot function on its own. A virus can reproduce only inside a living cell. They use this cell as a tiny factory, forcing it to make more viruses rather than healthy new cells.

Classifying Viruses

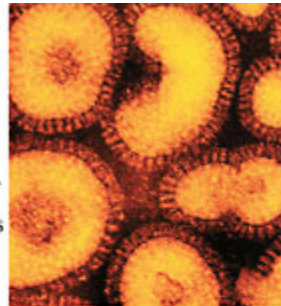
The four main shapes of viruses are shown in the pictures below. Every virus is made up of genetic material (DNA) inside a protein coat. The protein coat protects the genetic material and helps a virus enter a host cell.



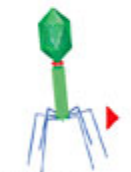
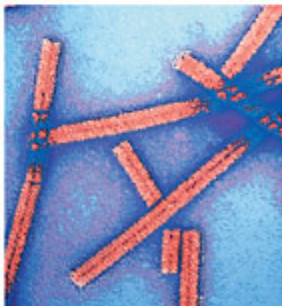
Crystals
The polio virus is shaped like the crystals shown here.



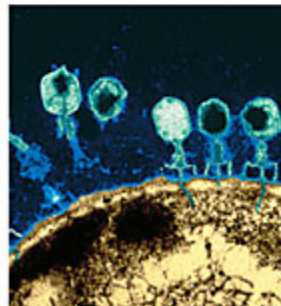
Spheres
Influenza viruses look like spheres. HIV is another virus that has this structure.



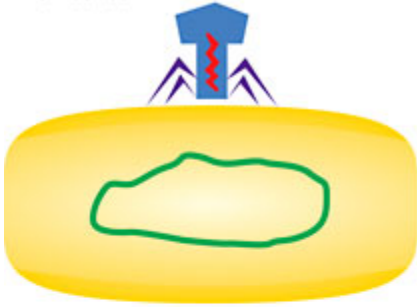
Cylinders
The tobacco mosaic virus is shaped like a cylinder and attacks tobacco plants.



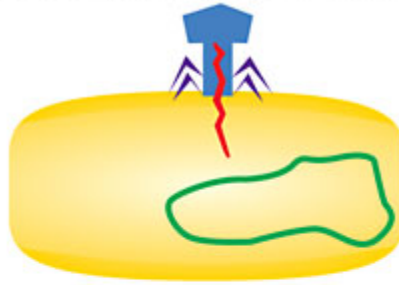
Spacecraft
One group of viruses attacks only bacteria. Many of these look almost like spacecraft.



1 The virus finds and joins itself to a host cell.



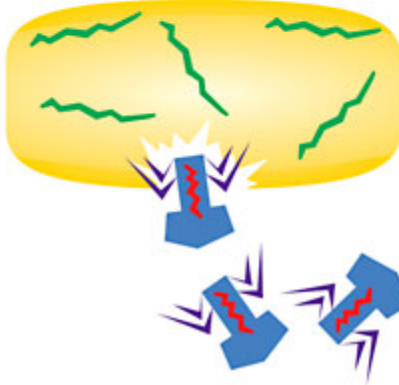
2 The virus enters the cell, or the virus's genetic material is injected into the cell.



3 Once the virus's genes are inside, they take over the direction of the host cell and turn it into a virus factory.



4 The new viruses break out of the host cell, which kills the host cell. The cycle begins again.



Treating a Virus

Antibiotics do not kill viruses (antibiotics only kill bacteria), but scientists have recently developed medications to treat diseases caused by viruses. Many of these medicines stop viruses from reproducing. Because many viral diseases do not have cures, it is best to prevent them from happening in the first place. Vaccinations, like the shots you get as a child, give your immune system a head start in fighting off viruses. It is also a good idea to wash your hands often and never to touch wild animals. If you do get sick from a virus, it is often best to rest and drink extra fluids while your body fights the disease.

Parasites



Parasites are living things that use other living things - like your body - for food and a place to live. You can get them from contaminated food or water, a bug bite, or sexual contact. They can go from animals to humans, from humans to humans, or from humans to animals.

Parasites range in size from tiny, from one cell, to worms that can be up to two meters (over 6 feet) long! The illnesses they can cause range from mild to terrible and possibly even death.

Prevention is especially important. There are no vaccines to prevent parasitic diseases, but some medicines are available to treat parasitic infections once a person gets the disease.

There are three main types of parasites that cause diseases in humans: protozoa, helminthes, and ectoparasites.

Protozoa are single-celled organism with an ability to multiply in humans. This means it takes only one to cause a very serious infection, because one can become many!

Protozoa usually get inside you by the accidental eating/drinking of fecal matter (poop)! This usually happens by eating dirty food, drinking dirty water or accidentally touching poop and not washing your hands well enough. Protozoa can also get in you from a bite from a fly, mosquito, sand fly, etc.

Helminths are a type of worm, and are generally large enough to be seen without a microscope. In their adult form, they cannot multiply in humans. The three main human parasite worm groups include:

Flatworms ~ flukes & tapeworms

Thorny-headed worms ~ adult forms reside in your gut

Roundworms ~ adult forms can reside in your gut, blood, lymphatic system, or below the skin

Ectoparasites burrow into your skin and can remain there for a while, in some cases months. These parasites include lice, fleas, ticks, and mites. Blood-sucking insects, such as mosquitoes, can also be included.

These biting bugs can cause diseases on their own, but more importantly, they often carry other disease causing microorganisms that get inside you when they bite you. These can cause diseases like malaria, yellow fever, dengue fever, and West Nile virus.

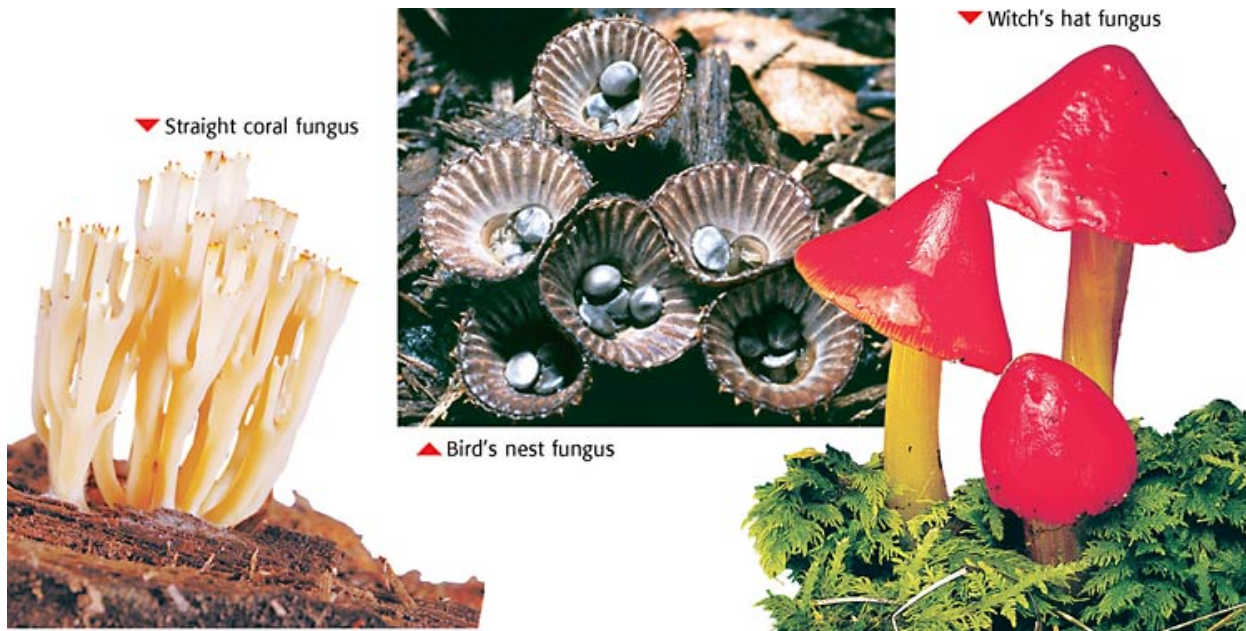
Parasitic infections cause a lot of disease. Malaria causes the highest number of deaths on the planet, killing about a million people every year.



Fungi

Characteristics of Fungi

Fungi have rigid cell walls and no chlorophyll (green pigment). They are so different from other organisms that they are placed in their own kingdom. As you can see in the pictures below, fungi come in a variety of shapes, sizes, and colors.



Food for Fungi

Fungi cannot catch or surround food. Fungi must live on or near their food supply. Most fungi do not make their own food. Instead, they get nutrients by secreting digestive juices onto a food source and then absorbing the dissolved food. Many fungi are decomposers, which feed on dead plant or animal matter.

All fungi are made of cells with a nucleus. Some fungi are single-celled, but most fungi are made of many cells. These many-celled fungi are made up of chains of cells called hyphae (HIE fee).

Making More Fungi

Reproduction in fungi may be either asexual or sexual. Asexual reproduction in fungi occurs in two ways. In one type of asexual reproduction, the hyphae (chains of cells) break apart, and each new piece becomes a new fungus. Asexual reproduction can also take place by the production of spores.

Kinds of Fungi

Fungi are classified based on their shape and the way that they reproduce. There are four main groups of fungi. Most species of fungi fit into one of these groups. These groups are threadlike fungi, sac fungi, club fungi, and imperfect fungi.

Threadlike Fungi

A **mold** is a shapeless, fuzzy fungus. This particular mold belongs to a group of fungi called *threadlike fungi*.

Sac Fungi



Sac fungi are the largest group of fungi. Sac fungi include yeasts, powdery mildews, truffles, and morels. But not all sac fungi are helpful. Some cause plant diseases, such as chestnut blight and Dutch elm disease.

Club Fungi

The umbrella-shaped mushrooms are the most familiar fungi. Mushrooms belong to a group of fungi called *club fungi*.

The most familiar mushrooms are known as *gill fungi*. Some are sold in supermarkets for food. However, not all gill fungi are edible. For example, the white destroying angel is a very poisonous fungus. Simply a taste of this mushroom can kill someone.



Imperfect Fungi

The *imperfect fungi* group includes all of the species of fungi that do not quite fit in the other groups. Most of these cause diseases in plants and animals. One common human disease caused by these fungi is athlete's foot, a skin disease.

Some imperfect fungi are useful. *Penicillium* is the source of the antibiotic penicillin. Other imperfect fungi are also used to produce medicines. Some imperfect fungi are used to produce cheeses, soy sauce, and the citric acid used in cola drinks.